WHAT IS CLAIMED IS:

1. A biological label comprising at least one luminescent color center, the color center comprising a nitrogen heteroatom substitutionally positioned on a diamondoid lattice site adjacent to at least one vacancy or pore.

2. The biological label of claim 1, wherein the diamondoid is a lower diamondoid selected from the group consisting of adamantane, diamantane, and triamantane, and heterodiamondoid derivatives thereof.

3. The biological label of claim 1, wherein the diamondoid is a higher diamondoid selected from the group consisting of tetramantane, pentamantane, hexamantane, heptamantane, octamantane, nonamantane, decamantane, and undecamantane, and heterodiamondoid derivatives thereof.

4. The biological label of claim 1, wherein the diamondoid-containing material containing the nitrogen heteroatom and vacancy or pore is selected from the group consisting of a molecular crystal, a polymerized material, and combinations thereof.

5. A biological label comprising at least one optically active dopant inserted into a diamondoid-containing material.

6. The biological label of claim 5, wherein the diamondoid is a lower diamondoid selected from the group consisting of adamantane, diamantane, and triamantane, and heterodiamondoid derivatives thereof.

7. The biological label of claim 5, wherein the diamondoid is a higher diamondoid selected from the group consisting of tetramantane, pentamantane, hexamantane, heptamantane, octamantane, nonamantane, decamantane, and undecamantane, and heterodiamondoid derivatives thereof.

8. The biological label of claim 5, wherein the diamondoid-containing material containing the nitrogen heteroatom and vacancy or pore is selected from the group consisting of a molecular crystal, a polymerized material, and combinations thereof.

9. The biological label of claim 5, wherein the optically active dopant is a rare earth, transition metal, actinide or lanthanide.

10. The biological label of claim 5, wherein the optically active active dopant is selected from the group consisting of titanium, vanadium, chromium, iron, cobalt, nickel, zinc, zirconium, niobium, cadmium, hafnium, tantalum, tungsten, rhenium, osmium, iridium, platinum, gold, mercury, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, and uranium.

11. The biological label of claim 1, wherein the diamondoid is derivatized with a functional group capable of binding to a target analyte.

12. The biological label of claim 1, wherein the functional group is a moiety selected from the group consisting of -H, -F, -Cl, -Br, -I, -OH, -SH, $-NH_2$, $-NHCOCH_3$, -NHCHO, $-CO_2H$, $-CO_2R'$, -COCl, -CHO, $-CH_2OH$, =O, $-NO_2$, $-CH=CH_2$, $-C\equiv CH$ and $-C_6H_5$, and where R′ is an alkyl group.

13. The biological label of claim 1, wherein the nature of the affinity between the diamondoid and the target analyte is selected from the group consisting of van der Waals attractions, hydrophilic attractions, hydrophobic attractions, ionic bonding, covalent bonding, an electrostatic association, and a magnetic association.

14. The biological label of claim 1, wherein the target analyte is selected from the group consisting of a protein, a sugar, a nucleic acid, an antigen, an antibody, a lipid, a cell, and a subcellular organelle.

15. The biological label of claim 1, wherein the bandgap of the diamondoid-containing material is at least about 2 eV.

16. The biological label of claim 1, wherein the bandgap of the diamondoid-containing material is at least about 3 eV.

17. The biological label of claim 1, wherein the bandgap of the diamondoid-containing material is at least about 4 eV.

18. The biological label of claim 1, wherein the bandgap of the diamondoid-containing material is at least about 5 eV.

19. The biological label of claim 1, further including impurity atoms that contribute electronic states within the bandgap of the diamondoid-containing material.

20. The biological label of claim 5, wherein the diamondoid is derivatized with a functional group capable of binding to a target analyte.

21. The biological label of claim 5, wherein the functional group is a moiety selected from the group consisting of -H, -F, -Cl, -Br, -I, -OH, -SH, $-NH_2$, $-NHCOCH_3$, -NHCHO, $-CO_2H$, $-CO_2R'$, -COCl, -CHO, $-CH_2OH$, =O, $-NO_2$, $-CH=CH_2$, $-C\equiv CH$ and $-C_6H_5$, and where R′ is an alkyl group.

22. The biological label of claim 5, wherein the nature of the affinity between the diamondoid and the target analyte is selected from the group consisting of van der Waals attractions, hydrophilic attractions, hydrophobic attractions, ionic bonding, covalent bonding, an electrostatic association, and a magnetic association.

23. The biological label of claim 5, wherein the target analyte is selected from the group consisting of a protein, a sugar, a nucleic acid, an antigen, an antibody, a lipid, a cell, and a subcellular organelle.

24. The biological label of claim 5, wherein the bandgap of the diamondoid-containing material is at least about 2 eV.

25. The biological label of claim 5, wherein the bandgap of the diamondoid-containing material is at least about 3 eV.

26. The biological label of claim 5, wherein the bandgap of the diamondoid-containing material is at least about 4 eV.

27. The biological label of claim 5, wherein the bandgap of the diamondoid-containing material is at least about 5 eV.

28. The biological label of claim 5, further including impurity atoms that contribute electronic states within the bandgap of the diamondoid-containing material.

29. A method of detecting a target analyte, the method comprising the steps of:

a) providing a heterodiamondoid-containing probe;

b) binding the heterodiamondoid-containing probe to the target analyte, thus creating a biological label;

c) exciting the biological label with energy such that the biological label is caused to luminesce; and

d) detecting light emitted from the excited biological label.

30. The method of claim 29, wherein the energy is in the form of a beam of photons, such that the luminescent event is photoluminescence.

31. The method of claim 29, wherein the energy is in the form of a beam of electrons, such that the luminescent event is electroluminescence.

32. The method of claim 29, wherein the energy is in the form of heat, such that the luminescent event is thermoluminescence.

33. The method of claim 29, wherein the energy is in the form of chemical energy, such that the luminescent event is chemiluminescence.

34. The method of claim 29, wherein the energy results from the frictional contact between two surfaces, such that the luminescent event is triboluminescence.

35. The method of claim 29, wherein step a) includes substitutionally positioning a nitrogen heteroatom on a diamondoid lattice site adjacent to at least one vacancy or pore.

36. The method of claim 29, further including the step of positioning impurity atoms within the diamondoid-containing material to create electronic states within the bandgap of the diamondoid-containing material.

37. The method of claim 29, further including the step of passing the biological label through a cell membrane after the heterodiamondoid-containing probe is bound to the target analyte.

38. The method of claim 29, further including the step of passing the heterodiamondoid-containing probe through a cell membrane, and then reacting the heterodiamondoid-containing probe with the target analyte.

39. The method of claim 29, wherein the detection of light emitted from the biological label is carried out using a photomultiplier tube.

40. The method of claim 29, wherein the detection of light emitted from the biological label is carried out using a charge-coupled device.